EXECUTIVE SUMMARY

Iodine on Demand (IOD) is a concept that has the potential to drastically simplify iodine delivery to a Chemical Oxygen Iodine Laser (COIL), a promising addition to our military arsenal. If the potential is realized, the size and weight of the iodine supply system for COIL will be reduced by an order of magnitude. Ground support and logistics are also simplified with the IOD concept.

Present COIL systems require that a pressure vessel containing molten iodine be maintained at temperature for whenever the laser is on alert and available for firing. This requires that either the iodine delivery system be continuously online or that several hours of notice be given before the COIL is to be fired. Care must be taken when melting iodine due to large volume changes that can stress the containment vessel, also, line pluggage could occur if residual clumps of solid iodine were present on start-up. In addition, existing iodine systems are complex and operational availability may be an issue. Due to the unusually corrosive nature of iodine, the time that the iodine system is maintained in its ready state must be factored into the system maintenance schedule and will reduce the overall system availability.

The IOD system delivers iodine to the COIL cavity on short notice from an iodine pyrotechnic, a solid-solid chemical iodine gas generator. The line to the laser cavity is preheated by an iodine free pyrotechnic and, after the laser shot, the system is purged by another inert pyrotechnic.

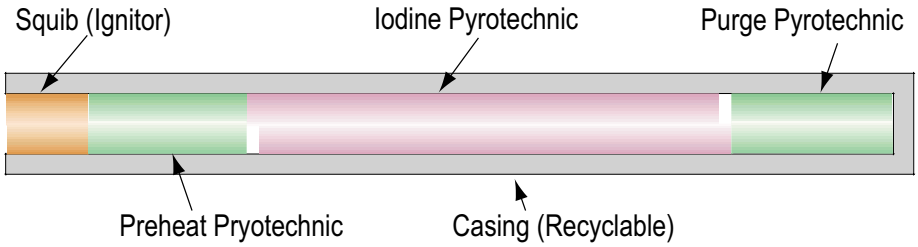

Diagram of Iodine-on-Demand cartridge. Iodine exits from the left end of the casing.

This work is the first phase of a proposed two-phase effort to demonstrate the basic feasibility of IOD. This basic feasibility demonstration is concerned only with the iodine pyrotechnic. The work scope was divided into three technical tasks, (1) screen potential fuel/oxidizer systems and systems for laboratory testing, (2) perform detailed safety analysis, and (3) perform burn test of selected fuel/oxidizer systems.

Forty solid-solid fuel/oxidizer systems were analyzed in terms of their potential to produce iodine vapor. The number of potential systems was kept low by only considering reactants that are catalog items or that can be readily made from catalog items. In

addition to the reaction products, the analysis included consideration of the adiabatic reaction temperature, T_a, the temperature of products the assuming the reactants were at room temperature. The promising reactions were tested for safety considerations for the purpose of eliminating unstable reactant systems. The performance of the chemical system in the safety tests also provided insight into the probable performance in an IOD system. Two systems, tetraiodoethylene/iodine pentoxide and tin/iodine pentoxide, were burn tested under conditions similar to that required for IOD operation. More testing is required but both systems performed adequately and, on the basis of present knowledge, either system could be used as the basis for a fieldable iodine supply system for a COIL weapon system. It is recommended that both systems be further examined in Phase 2 of this work.